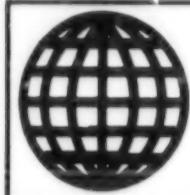


JPRS-CEN-90-011
25 SEPTEMBER 1990



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JPRS Report—

Science & Technology

CHINA: Energy

Science & Technology

China: Energy

JPRS-CEN-90-011

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25 September 1990

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Energy Output Shows Increase in First Quarter of 1990

906B0073C Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 7 Apr 90 p 3

[Article by reporter Zhang Chaowen [1728 6389 2429]: "Comprehensive Increase in Energy Resource Production in China in First Quarter of 1990, Output of Coal, Power, Oil, and Natural Gas Up From Same Period in 1989"]

[Text] There are new reports of victories in China's energy resource industry for the first spring of the 1990's. There were sustained comprehensive increases in coal, power, oil, and natural gas output.

For raw coal output, China produced 227.6 million tons in the first quarter of 1990, up 5.6 percent over the same period in 1989. This includes 118.36 million tons of raw coal produced by the coal industry's "national team," China's unified distribution coal mines. Output exceeded quotas by more than 300,000 tons at Lu'an, Tiefa, Datong, Yima, and Jixi mining bureaus.

China produced 33.83 million tons of crude oil in the first quarter of 1990, up 1.4 percent over the same period in 1989. Daqing, Shengli, Jilin, Changqing, and other oil fields exceeded oil output quotas.

For electric power output, China generated 143.3 billion kWh of power in the first quarter of 1990, up 8.67 percent over the same period in 1989. Hydropower output was up by 12.81 percent and thermal power output was up by 7.97 percent. Because shipping departments focused on arrangements for coal used to generate power, they create favorable conditions to increase power output in the four big North China, East China, Northeast China, and Central China grids.

In the 1980's, China quickly became a major world nation in production of tertiary energy resources. During the first spring of the 1990's, production in the energy resource industry maintained an excellent growth momentum. People in the economics field have pointed out that it will provide an effective guarantee for sustained and stable development of China's national economy.

State Sets Guidelines, Production Targets for Energy Industry

906B0072A Beijing JINGJI XIAOXI in Chinese 29 Mar 90 p 1

[Article by Wang Jian [3769 6015]: "State Determines Basic Principles and Production Goals for Energy Resource Industry—Combine Development and Conservation, Try To Raise Energy Resource Utilization Rates"]

[Text] Minister Huang Yicheng [7806 3015 6134] of the Ministry of Energy Resources recently set forth basic

principles and production goals for China's energy resource industry at a press conference for Chinese and foreign reporters.

He said that the energy resource industry is a basic industry and that development of the energy industry is essential for China's modernization. The basic principle for China's energy resource industry is: continue to adhere to the principle of combining development and conservation. Energy resource development should focus on electric power, make coal the foundation, actively develop petroleum and natural gas, strive to develop hydropower and nuclear power, and accelerate construction of rural energy resources and electrification. There should be major efforts to conserve electricity, oil, and coal, extend heat and power cogeneration, develop surplus heat utilization, continue implementation of the policy of substituting coal for oil, strive to improve the energy resource production structure and consumption structure, raise energy resource utilization rates, and reduce environmental pollution. China's energy resource production goals planned for the year 2000 call for primary energy resources equal to 1.4 billion tons of standard coal (including non-commodity energy resources and new energy resources). This includes 1.4 billion tons in raw coal output, 200 million tons of petroleum, 30 billion cubic meters of natural gas, 240 billion kWh of hydropower, and 30 billion kWh of nuclear power. Total power generation in China should reach 12,000 kWh [as published, probably means 1,200 billion kWh] and the installed generating capacity should be 240,000 MW (not including small-scale hydropower and pumped storage power stations).

To deal with these goals, the main strategic deployments for China's energy resource industry in the future are: 1) Take full advantage of our abundant coal resources and accelerating development of coal. The focus should be on developing coal in Shanxi, Shaanxi, and western Inner Mongolia in conjunction with faster development of coal in northeast and east China. Local coal mines (including township and town coal mines), which produce over one-half of China's coal, should strengthen professional management and carry out rectification and transformation to promote even healthier and more stable development. 2) Take full advantage of our abundant hydropower resources and accelerate hydropower construction, and focus on developing the upper reaches of the Huang He, the trunk and tributaries of the Chang Jiang, Hongshui He, Wu Jiang, and Lancang Jiang. We also should push to build several medium-sized hydropower stations and several pumped storage power stations. 3) Actively develop pit-mouth thermal power plants, shift from hauling coal to transmitting power, and reduce pressures on railway transport. 4) Gain an understanding of nuclear power plant manufacturing technologies and create the conditions for even faster development of nuclear power after 2000. 5) Reinforce petroleum and natural gas prospecting and development

to create the conditions for improving China's energy resource production and consumption structures.

Energy Industry Growing at Near World Record

*906B0072B Beijing RENMIN RIBAO in Chinese
16 Mar 90 p 1*

[Article by reporter Cao Ruitian [2580 3843 1131]: "Few Countries in the World Can Match the Rate of Growth in China's Energy Resource Industry—We Are in the World's Front Ranks in Raw Coal, Crude Oil, and Natural Gas Output, Fourth in the World in Electric Power Output, and Moving From Nothing to Something in Nuclear Power Construction"]

[Text] Minister Huang Yicheng [7806 3015 6134] of the Ministry of Energy Resources announced to Chinese and foreign reporters in Beijing on 14 March 1990 that China had entered the ranks of the world's great energy nations. Total output of primary energy resources reached 1 billion tons of standard coal in 1989, a 43.5-fold increase over the 1949 figure of 23 million tons of standard coal and an average yearly growth rate of 9.9 percent.

While describing the development situation for energy resource production and construction in the 40 years since the People's Republic of China was founded, Huang Yicheng said that in particular reform and opening up during the past 10 years had brought burgeoning development to energy resource production and construction in China. Raw coal output reached 1.04 billion tons in 1989, first place in the world, a 32.5-fold increase over 40 years, and an average yearly growth rate of more than 9 percent.

Crude oil output in 1989 reached 137.6 million tons, fifth place in the world and a 1,146-fold increase over 40 years. Natural gas output also reached 1.45 billion cubic meters, a more than 2,000-fold increase.

Especially gratifying were the major oil and gas exploration discoveries in Tarim Basin which may lead to formation of a relatively large-scale new oil province.

China's electric power industry, a secondary energy resource, produced 582 billion kWh of power in 1989, fourth place in the world, a 135-fold increase over 40 years, and an average yearly growth rate of 13 percent. The total installed generating capacity for electric power equipment in China reached 124,500 MW, fifth place in the world. Nuclear power construction is moving from nothing to something. Equipment installation for the first-stage project at Zhejiang's Qinshan Nuclear Power Plant, designed and manufactured by China itself, is nearing completion. Debugging operation will begin in 1990 and it may be connected to the grid and generate power by the end of 1990. Guangdong's Daya Bay Nuclear Power Plant project is proceeding according to plan. Construction is moving ahead quickly and quality is good. It has now moved into the key period of nuclear

island and conventional island installation and the two 900 MW generators will begin generating power in 1992 and 1993, respectively.

The rapid rate of growth in China's energy resource industry is seldom encountered in other nations of the world. Huang Yicheng pointed out that this fully displays the superiority of the socialist system and provides an effective confirmation of the correctness of the principle of reform and opening up.

Power Industry's Technology Policy for 1990's Studied

906B0056B Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 13 Mar 90 p 3

[Article by Hsu Jintao [6079 6855 3447] and Wang Changhai [3769 7022 3189]: "China's Electricity Industry Technology Policy in the 1990's Studied"]

[Excerpt] The electricity industry is an important part of basic industry. It precedes the advancement of the national economy and it is at the center of energy development. In the last 40 years, China's electricity industry achieved world-renowned accomplishments. Generator installed capacity increased from 1.85 million kilowatts in 1949 to 116 million kilowatts in 1988. In 1989, production exceeded 124 million kilowatts. The electricity generated annually grew from 4.3 billion kilowatt-hours to 545 billion kilowatt-hours. In 1989 it reached 577.5 billion kilowatt-hours. In the two areas mentioned above, China enhanced its position among other countries from 21st and 25th to 5th and 4th respectively. However, according to the average per capita use of electricity, China still ranks very low among other countries. There are about 300 million people who do not have electricity. Due to a long history of imbalance in the appropriation of capital, the supply and demand ratio of electricity has steadily worsened.

As shown by experience in other countries, in the infancy of industrialization, the growth of energy, especially that of the electricity industry, generally exceeds that of the gross national product. That is to say, the ratio of energy and electricity elasticity coefficient is greater than 1. In order to achieve the goal of quadrupling the 1980 industrial and agricultural annual production value by the year 2000, the growth of the power industry has to at least keep up with the national economy (electricity elasticity coefficient at 1). This means that by the year 2000, the generator installed capacity must reach 240 million kilowatts, and the annual electricity generation will have to exceed 1,200 billion kilowatt-hours. In order to achieve this goal, it is necessary to regulate the ratio of the structure of production and investment at the macroscopic level, improve the system of administration, improve to standard of administration and develop channels for multi-level investment. In addition, it is necessary to emphasize the development of science and technology and establish correct energy policies. This is necessary in order to develop China's main technological

economic goal in the power industry so that by the year 2000 it can reach the average level of industrialized countries in the late 1970's or early 1980's. Whether this can be achieved depends on the following major policies regarding technology:

1. Implementing superior systems, using energy resources appropriately. Starting from the prospects of developing China's energy and electricity needs, together with economic considerations, and social and environmental factors, maximum economy should be achieved in the appropriate structure of energy resources, electrification, the structure of electrical grids, and the progression of construction in the development of the power industry. China now has the ability to plan the technical means, the question is how to coordinate the plans and scientific policies thus developed. This is necessary because the investment in the energy industry is large, the construction time is long, and any errors in calculation can cause huge losses.

2. Use and develop the advantages of hydropower. Investment in the construction of hydropower stations is greater and land loss due to submersion must be considered. However, hydropower stations are inexpensive to operate, efficient, and there are side benefits of flood prevention, irrigation, and navigation. In the long run, hydropower has distinct advantages. The development of hydropower should begin with river sections with superior features for power generation. The stations should be large-scale. Cascades should be developed and use of the stations should be coordinated.

3. Improve thermal power technology, accelerate thermal power construction. The particular situation in China's energy resources and the grave shortage of electricity and capital requires that thermal power will be the main source of electricity for years to come. In the next 10 years, an additional 85 million kilowatts of coal-fired thermal power will be added; 300 million tons of additional raw coal will be burned. This is to say that future coal production will go mainly to the generation of electricity. Coal production and supply will be the limiting factor in the development of thermal power. Therefore, it is important to emphasize research in thermal power technology. This will bring about more efficient electricity generation and higher levels of operational safety. By the year 2000, China's thermal power plants may reduce the coal used to generate electricity to 380 grams per kilowatt-hour. This is approximately an average reduction of 50 grams per kilowatt-hour. Newly constructed stations should not exceed a waste ratio of 330 grams per kilowatt-hour. When this goal is achieved the total amount saved per year will be an average of 70 million tons of raw coal or 48 million tons of standard coal.

Environmental pollution will be another limiting factor in the development of thermal power. By the year 2000, with plant capacity estimated at 170 million kilowatts, the amount of ash generated per year will be 150 tons. Suspended particulates in the atmosphere will be

approximately 12 million tons. Sulphur dioxide will reach an approximate level of 10 million tons. This huge amount of pollutants will create a grave burden on the environment. Therefore, in the next 10 years, solutions have to be found to improve the technology of environmental protection and the coordinated utilization of waste materials, waste heat, and waste water in thermal power plants. This is indeed an important task for the power utility authorities.

4. Master and further develop nuclear technology. Develop nuclear power in the east where conventional energy resources are lacking in order to rapidly develop the region's economy. This is the most practical plan. In the next 10 years, on the basis of developing China's nuclear technology and introducing and assimilating nuclear technology from other countries, China should steadily develop its own nuclear technology, and prepare for major developments in nuclear power after the year 2000 by furthering the development of nuclear technology.

5. Establish large power grids, fully realize their benefits. Enlarging power grids provides significant economic benefits. For example, energy resources can be more appropriately used; reserve volume of networks can be reduced; peak load consumption can be reduced because of time zone differences; economy and reliability can be enhanced when the operation of the system is improved.

The following technical problems have to be solved: how to transmit long distances voltages of 500 kilovolts and higher, how to economically and safely operate large power grids, and how to provide technology and equipment to solve high-tech problems such as continuous electrical supply protection, long-distance transmission, communications, and self-regulation and automation.

6. Actively develop new energy resource research and utilization. The system of energy supply based mainly on fossil fuels will face a grave problem of shortage in the not-too-distant future. According to the world's verified energy reserve and current consumption levels, by the year 2020, petroleum and natural gas will have been exhausted. Even after additional reserves are considered, the supply can only last until the year 2060. Even though coal resources are more abundant, the acid rain and greenhouse effect that accompany the burning of coal will be a major hindrance to the large-scale use of coal as a fuel. In order to satisfy the ever increasing consumption of fuel, and at the same time protect the environment on which existence depends, the eventual direction of energy use will undoubtedly turn to wind power, solar power, tidal power, and other renewable, clean sources. Developed countries in the world have been actively researching and testing new sources of energy. China's resources are abundant, the level of consumption is low, and there will not be a shortage problem in the short run. However, long-term plans should be made. [passage omitted]

Power Industry Technology Reforms Show Significant Effect

906B0097A *Beijing RENMIN RIBAO* in Chinese
24 May 90 p 2

[Article by Cheng Jian [2052 1696], New China News Agency, and Chen Hua [7115 5478] of RENMIN RIBAO]

[Text] Chengdu, 23 May—The theme stressed at the All-China Work Conference on Electric Power Technology Reform and Progress held in Chengdu was that of technology reform.

As presented at the conference, technology reform and improvement in China's power industry have developed rapidly since the 3d Plenary Session of the 11th Central Party Committee. In the decade from 1980 to 1990, the state spent 15.7 billion yuan on technology reform and improvement. In the million-yuan-plus project category of total investment, 2,862 projects were completed, improving and reforming power generation equipment, enhancing the safety level of power generation, reducing environmental pollution by power plants, and raising the level of automation. As a result, 4 million kW of additional power generating capacity has been obtained, with output raised by more than 100 billion kWh.

When summarizing the decade's experiences in technology reform and progress in the power industry, the conference pointed out that the general level of China's power industry equipment is still relatively backward. In particular, much of the low-performance and inefficient, old, and obsolete equipment cannot be retired due to the protracted power shortage. Furthermore, some technically backward equipment is joined to the power networks, so that the task of technology reform remains enormous and difficult. As pointed out by Vice Minister Shi Dazhen [0670 1129 2823] of the Ministry of Energy Resources at the conference, when the power industry relies on capital construction in expanding reproduction, emphasis must be placed on exploiting power generation potential within a power bureau. Beginning from the Eighth 5-Year Plan, power technology reform should gradually shift toward technical progress as its main target. As understood from the requirements of the Technology Reform Planning Outline of the Power Industry as stipulated by the Ministry of Energy Resources, an increase of power supply of 70 billion kWh and a saving of 6 million tons of raw coal can be obtained upon completion of the technology reform mission during the Eighth 5-Year Plan period.

Energy Industry To Strengthen Ties With Foreign Interests

906B0056A *Beijing RENMIN RIBAO OVERSEAS EDITION* in Chinese 16 Mar 90 p 3

[Article by Huang Xiaonan [7803 2556 0589]; "Huang Yicheng [7803 3015 6134]: Energy Industry Will Continue To Increase Cooperation With Other Countries"]

[Text] Beijing, New China News Agency, 14 Mar—Energy Minister Huang Yicheng disclosed today that

China's energy industry is the one that attracted the most foreign investment. It represents one-fifth of the total foreign investment in China. He said that China will continue to cooperate with the rest of the world in the future.

Huang Yicheng described China's use of foreign investment and technology in the speeding up of China's energy industry. He said that this is an important component of China's insistence on reform and openness.

He said that in the last 10 years of reform in China, the area of energy has generated much international exchange and cooperation. China's energy export is third among all export areas. Importation of energy and high energy use products exceeds 30 percent.

Up to the present time, 1.7 billion U.S. dollars worth of foreign capital has been invested in China's coal industry. There are 12 construction projects with a total output of 49.2 million tons. Of these, one of China's largest cooperative projects is the Pingshuo strip mine in Shanxi, with an annual yield of 15.33 million tons and an investment of 650 million U.S. dollars.

Huang Yicheng said that the total amount of signed contracts to perform offshore oil drilling has reached 2.6 billion U.S. dollars. In the power industry, total cooperative contracts amount to 5.74 billion U.S. dollars. Of this, six projects involve hydropower stations (1.5 billion U.S. dollars) and 22 thermal power stations totaling 4.59 billion U.S. dollars.

The World Bank has provided loans for the Lubuge and Shuikou hydropower projects, some thermal power projects and electricity transmission and transformation projects. In addition, China has been using loans from Japan, the United States, France, Italy, Spain, Canada, Kuwait and other countries to construct hydropower and thermal power plants.

Huang Yicheng emphasized that China will continue to increase the level of exchange and cooperation in the area of energy with other countries and international financial organizations.

Work Proceeding Smoothly on Six Major Energy Projects

906B0073B *Beijing RENMIN RIBAO OVERSEAS EDITION* in Chinese 3 Apr 90 p 1

[Article by reporter Zhang Chaowen [1728 6389 2429]; "Construction Proceeding Smoothly at China's Six Big Key Power Stations, Total Investment 7.68 Billion Yuan, Total Installed Generating Capacity Exceeds 6,400 MW"]

[Text] Construction is proceeding smoothly at China's six big key power stations which involve total invest-

ments of 7.68 billion yuan and will have a total installed generating capacity in excess of 6,400 MW.

In south China, since construction of the main project at Guangxi's 1,210 MW Yantan Hydropower Station in the middle reaches of Hongshui He began in March 1985, 51 percent of the project has been completed and the quality of nine key and permanent projects has passed examination and acceptance with excellent quality. Moreover, it has saved almost 100,000 tons of cement for the state.

In central China, pouring of the concrete for the generator housings has already begun at Hebei's Geheyuan Hydropower Station with an installed generating capacity of 1,200 MW located on the Qing Jiang in the mountains of southwest Hebei and progress on all of the projects is moving ahead of schedule. An excellent foundation has been laid for connecting the first generator to the grid and power generation in July 1993.

In east China, preparatory work for Changshu Power Plant being built north of the Chang Jiang is now fully underway and the "three openings and one leveling" work in the plant area are basically finished and foundation construction for the main plant building at the site now exceeds 20,000 cubic meters of foundation. The first stage of the Changshu Power Plant project has an installed generating capacity of 1,200 MW and will generate 6.6 billion kWh of power annually, which will play a major role in solving the electric power shortage in the east China region.

Initial construction of the second-stage project at Harbin No 3 Power Plant with an installed generating capacity of 1,200 MW on the banks of Hulan He is now fully underway. All of the "five openings and one leveling" work in the plant area has been completed and prefabrication of the foundation for the main plant building is now finished.

In northwest China, the civil engineering project for Ningxia's Daba Power Plant with an installed generating capacity of 600 MW is now proceeding smoothly and the 210-meter tall smokestack, the main structure, was completed 82 days ahead of schedule. The entire power plant will connect to the grid and generate power in 1991.

In north China, construction at Shanxi's Shentou No 2 Power Plant is proceeding quickly and the quality is good. Successive new records have been set in the civil engineering project, the most in China. Over 120 meters of the two 270-meter smokestacks have now been completed. Shentou No 2 Power Plant has now completed 425 million yuan in investments, more than 29 percent of the total investment.

Research on MHD Applications of Great Significance to Power Sector

906B0073D Beijing GUANGMING RIBAO in Chinese
29 Mar 90 p 1

[Article by reporter Liu Lusha [0491 6424 3097]: "Research on Magnetohydrodynamic Power Generation Proceeding Quickly in China, Major Significance for Changing Electric Power's Backward State of Low Efficiency and High Pollution"]

[Text] I learned on 28 March 1990 from the State High-Technology Planning Magnetohydrodynamics [MHD] Power Generation Expert Group that China is closely tracking advanced world levels in the MHD high-technology power generation realm and has made noteworthy progress.

MHD power generation is a new-high-efficiency, low-pollution method of power generation that all developed nations of the world are now competing to study. Common thermal power generation requires converting high energy into mechanical energy and then into electrical energy at a maximum efficiency of just 33 to 36 percent. MHD power generation allows a plasma created by burning coal (petroleum, natural gas) added to an oxidizing agent and additives to pass through a magnetic field at high speeds, which converts high energy directly into electrical energy. The maximum efficiency of magnetohydrodynamic-steam combined cycle power generation equipment is as high as 55 percent, and it is capable of automatic desulfurization and causes little pollution. Coal is China's main energy resource, so the development of coal-fired MHD power generation technologies is of extremely great significance for changing the backward state of low efficiency and high pollution in China's electric power.

Development of MHD power generation technologies has already been included in China's high-technology R&D plans, and all relevant units are cooperating in a division of labor under leadership by the Expert Group to foster the advantages of each unit and achieve rapid progress in this area of research. China has already built a 2 MW short-term oil-fired MHD power generation experimental generator which has a maximum power generation power of 2.220 MW, attaining advanced international levels at the present time. We have completed a 5 MW coal-fired MHD-steam combined cycle device and successfully carried out hot-state debugging experiments. We have completed a 200-hour dynamic experiment on power generation channel electrode materials and insulating materials. We have also made preliminary achievements with combustion chambers, power generation channels, magnets, contravariant current, surplus heat boilers, seed [as published, probably means neutron] recovery and regeneration, and other areas.

According to Expert Group chairman Ju Zixiang [1446 3320 6272], China is now building a coal-fired MHD-steam combined cycle upstream experiment base area

with a heat power of 25 MW and a downstream base area with a heat power of 5 MW. Ignition is expected at the end of 1990. We are also winding a big 4.5-Tesla superconducting horseshoe magnet. China plans to build a 10 MW-grade coal-fired MHD-steam combined cycle pilot power plant by the end of this century and will try to achieve commercialized MHD power generation at the same time as the developed nations in 2010.

Electricity Now Reaching 95 Percent of Rural Villages
906B0073A Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 6 Apr 90 p 3

[Article by reporter Xia Lin [1115 2651]: "China Rural Electrification Work Conference Points Out Burgeoning Development of Rural Electric Power Construction, Huge Power Grids Now Extend to 95 Percent of Rural Villages"]

[Text] A spokesman for the Ministry of Energy Resources pointed out recently in Tianjin that rural villages are now the areas of fastest growth in power use in China. In 1989, China's villages used 192 billion kWh of electric power, 3.7 times as much as in 1978.

The China Rural Electrification Work Conference is now in session in Tianjin. The spokesman pointed out that electricity in China's rural villages has grown at an average yearly rate of 14 percent over the past 10 years, and there have been obvious changes in the structure of power use. Within rural power consumption in 1989, 115.3 billion kWh was used in township and town enterprise production.

China is a large agricultural nation with 850 million of its 1.1 billion people living in rural villages. Agricultural production, especially grain production, has always been the foundation for development of the national economy. For this reason, the Chinese government has paid special attention to rural electric power construction to serve agricultural production and life.

China's rural electric power system now employs 1.5 million people and huge electric power grids now extend into 95 percent of China's villages. Data provided by the Ministry of Energy Resources indicate that China's rural areas have 6.27 million kilometers of high-voltage and low-voltage power lines. Power transformer stations are scattered everywhere and now total 12,194 sites. The installed generating capacity in rural power stations is 20,120 MW and 2 billion yuan in capital has been invested in equipment transformation since 1978.

The electric current flowing in a steady stream to rural villages has played a role in improving the backward situation in rural areas that cannot be ignored. China's electric power departments estimate that each kWh of power supplied to rural villages can create 3 yuan renminbi in value of output. In 1989, electricity use for agricultural spring irrigation and summer drainage reached 18.9 billion kWh. In China, a traditionally

agricultural nation, 300 million mu of improved fields now rely on electric power for irrigation.

Vice Minister Lu Youmei [7120 0147 2812], who is in charge of rural power use in the Ministry of Energy Resources, said that although rural electric power construction is developing very quickly in China, it still cannot meet the needs of agricultural development and the electric power shortage persists.

Shanxi Power Base Begins To Take Shape

906B0097B Taiyuan SHANXI RIBAO in Chinese 23 Jun 90 p 1

[Article by Du Wenfeng [2629 2429 1496] of New China News Agency]

[Excerpts] Taiyuan, 20 Jun (SHANXI RIBAO)—Today, Shanxi ranks first in China in coal output, coal supply, to other provinces, coal exports, and power supply to other provinces.

Proven coal reserves in Shanxi Province are 257 billion tons, approximately one-third of China's coal resources. The capital investment share of energy resources with respect to total capital investment in Shanxi Province rose from 24 percent in 1979 to about 50 percent last year. Over the span of a little more than a decade, investments in the capital construction of energy resources in Shanxi Province was 16,726 million yuan, nearly three times the total investment of the energy industry for 29 years since the People's Republic was founded.

[Passage omitted] Last year, Shanxi produced 275 million tons of raw coal, an increase of 13.8 percent over the previous year; the province's output was one-quarter of China's total raw coal output. The coal mines in the province are actively upgrading mechanized and modernized mining of coal. Since 1978, added capacity in raw coal mining has been 54.06 million tons.

Shanxi's power generation industry is comparable to its coal output. In 11 years, the added capacity of power generation equipment amounted to 3,250,900 kW. Last year, the province's installed capacity of power generation equipment was 5,316,000 kW, and its power generation amounted to 30.19 billion kWh, an increase of 9.2 percent over the previous year.

In addition, the province provides energy products to other provinces and for export, totaling 199 million tons, or 78 percent of coal supply to other areas (including 11.43 million tons of coal for export, or 67 percent of China's total coal exports). In addition, the province transmitted 5.68 billion kWh of power to other provinces and municipalities last year.

Shanxi's capability for energy base construction gives it pivotal status in building the national economy. One of every four enterprises among the hundreds of thousands of industrial and transportation enterprises in China uses coal from Shanxi. One-quarter of the national income is related to coal from Shanxi; one-quarter of electric power in Beijing Municipality comes from Shanxi.

New Insulator Material for Power Lines

906B0069B Beijing BEIJING KEJI BAO [BEIJING SCIENCE AND TECHNOLOGY NEWS] in Chinese
14 Feb 90 p 2

[Article by Hu Jinzhou [5170 6855 3166]: "China Successfully Develops New Type of Synthetic Insulator for Power Transmission Lines"]

[Text] A project to attack key S&T problems with important technical equipment during the state's Seventh 5-Year Plan which concerns a new type of synthetic insulator for power transmission lines formally passed expert examination and approval organized by the Ministry of Energy Resources at Hubei's Xiangfan Electric Power Equipment Plant on 13 February 1990.

In the early 1980's, Wuhan Hydropower College, Hubei Provincial Chemistry Institute, and Wuhan High Voltage Institute assumed joint responsibility for scientific research on 500 kV synthetic insulators. The three institutions worked hard at repeated experiments with over 200 mixtures and used a synthetic insulator material based on silicon rubber as a substitute for traditional ceramic insulators. This led to a basic innovation in technical equipment for insulating techniques on China's high voltage power transmission lines. They are obviously superior to ceramic insulators. The products were manufactured using new technologies, new techniques, and new materials. They are light in weight and not easily broken, and are extremely convenient to ship, store, install, and maintain. They reduce labor intensity, conserve project investments, promote miniaturization of pole and tower designs, and increase the social and economic benefits of electric power construction.

The 110 kV synthetic insulators which served as the first-stage achievement passed technical examination and acceptance in 1985, and they have been in use on Wuhan's power transmission lines and at Fushun Charged Contaminant Collection Station (near the aluminum plant) until now. Practice has proven that their operation conditions are excellent. After receiving a gold medal at the First International Patent and Technical Equipment Exhibition in November 1988, they were put into production at Hubei's Xiangfan Electric Power Equipment Plant. In just 1 year they successfully produced 110 kV and 220 kV synthetic insulators which underwent industrial testing at Beijing, Changsha, Lanzhou, and other areas. No safety or reliability problems occurred. After experts at the conference earnestly listened to summary reports on product development and trial production and the views of users on their utilization, examined technical documents submitted for examination and approval, and inspected all the assembly equipment, production process, and experimental projects for products leaving the plant, they decided that the 110 kV synthetic insulators had passed product examination and approval and could be produced in large quantities. They agreed that the 220 kV synthetic insulators had passed technical examination and approval and that trial production and an expanded

trial utilization scale could be done to accumulate operating experience that would provide a foundation for wider extension and utilization and accelerate the conversion of the S&T achievement. The products are being sold under the supervision of Beijing's Zhongguang Integrated Electric Power Equipment Company, and Wuhan High Voltage Institute is responsible for quality supervision.

Experts consider the design for the synthetic insulators to be rational and the technology reliable. They have superior contamination prevention properties and this achievement has particularly Chinese characteristics. It also attained advanced international levels.

Shanxi Greatly Increases Installed Capacity

906B0069A Taiyuan SHANXI RIBAO in Chinese
22 Feb 90 p 1

[Article by Kang Xiaoming [1660 1420 2494] and Shang Jinsheng [1424 2516 3932]: "Shanxi Province Has More Installed Electric Power Capacity and Larger Single Generating Unit Capacity in 1990—First 300 MW Generator To Begin Operating at End of 1990, Installation of First 500 MW Generator To Be Completed at End of 1990"]

[Text] Reporters learned from the Shanxi Provincial Electric Power Work Conference held recently that Shanxi Province will install more electric power generators with larger single generating unit capacities in 1990 on an unprecedented scale. They include two 210 MW generators at Zhangze Power Plant which will begin operating in July 1990 and at the end of 1990, respectively, Shanxi's first 300 MW generator, which will go into operation at Taiyuan No 1 Thermal Power Plant at the end of 1990, and Shanxi's first 500 MW generator at Shentou No 2 Power Plant, where installation will be completed by the end of 1990. During 1990, Shanxi Province will ensure that 510 MW of generating unit capacity will be placed into operation and will try to put 770 MW into operation.

In 1989, through the joint efforts of electric power employees throughout Shanxi, the Shanxi Provincial Power Bureau completed state power generation plan tasks 54 days ahead of schedule and annual contractual responsibility goals 4 days ahead of schedule. It made five breakthroughs: power output surpassed 30 billion kWh, the number of power plants with an installed generating capacity of more than 500 kW surpassed 100, capital construction investments surpassed 1 billion yuan, the value of output completed surpassed 1.5 billion yuan, and actual profits and taxes surpassed 500 million yuan. Although Shanxi Province's electric power industry has grown rather quickly, we still have an extremely severe power shortage. For this reason, the focus of work in the Shanxi Provincial Electric Power Bureau during 1990 is being placed on adhering to safety, economy, stable output, and greater supplies, trying in every possible way to increase labor productivity and economic results, and full efforts to guarantee

POWER NETWORK

JPRS-CEN-90-011
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completion of generator operationalization tasks for 1990 according to schedule. In 1990, the state is providing Shanxi Province with nearly 1 billion yuan in capital construction investments for electric power, including 850 million yuan for power generation

projects. Stronger leadership by the Shanxi Provincial Electric Power Bureau and implementation of an economic responsibility system for project installation and startup which inspects work schedules by stages have accelerated project progress.

Largest Joint Venture Power Plant on Schedule

40100076A Beijing CHINA DAILY (PROVINCES/INFORMATION) in English 3 Sep 90 p 3

[Article by Zhong Chen, CD staff reporter]

[Text] Workers are halfway through the first phase of construction of the Ligang Power Plant in Jiangsu's Wuxi, considered to be the country's largest joint venture power plant, and the project is continuing smoothly.

A 240-metre-high chimney has been erected and 225-ton boilers from the America's Foster Wheeler Trading Company have been installed.

The first phase, with two generating sets from Italian companies, is expected to be finished by the end of next year, said Yan Weizhong, deputy manager of the Financial and Planning Department under the Jiangsu Ligang Electric Power Company Ltd.

The project consists of three phases with a total generating capacity of 2.6 million kilowatt-hours.

At a cost of 1.66 billion yuan shared by Citic's Xinli Energy Development Company, the province's Investment Company, Wuxi's Local Electric Power Company and Hong Kong Xinhong Electric Power Investment Company Ltd., the generating sets will provide 70 per cent of the city's generated energy.

"By then the city's electricity shortage will be eased," said Yan.

The project is strategically located on the Yangtse River to make it convenient for transportation facilities.

The thermal power plant calls for more than 2 million tons of coal each year to be transported from Shanxi Province, however, the coal cannot be carried along the bulging Shanghai-Nanjing railway line.

A work force of more than 4,000 is trying to complete the project on schedule.

So far a 1.7 million-square-metre slag heap and a 30,000-ton coal wharf have been completed.

Since the installation of the foundation, work has begun on the second phase of engineering, said Yan.

Coal Supply Said Assured for Rest of 1990

40100074A Beijing CHINA DAILY (Economics and Business) in English 21 Aug 90 p 2

[Article by staff reporter Huang Xiang]

[Text] A stable coal supply for the rest of the year has been predicted by the Ministry of Materials despite an expected slower increase in production and a rise in consumption.

Coal output registered a 6.33 percent rise by the end of June over the same period last year while consumption rose by only 3.76 percent, according to a Ministry source.

A coal shortage has plagued China for the past decade and has cost the nation billions of yuan in lost industrial and agricultural output value.

Most experts attribute the situation to an overheated economy, a disordered market and poor transportation.

However the coal supply has gradually eased as industrial output started to fall in 1989 following the launch of the austerity programme.

The Ministry source said enterprises under the Ministry of Energy Resources and the Ministry of Metallurgical Industry, both major consumers of energy, complained that their coal stocks are "now too much to bear."

With nationwide stockpiling, the Ministry said slowed coal production is inevitable.

China plans to increase coal production by 20 million tons in 1990.

As industry has started to pick up since April, coal consumption has also risen, the Ministry said.

But the growth rate will be somewhere around 6 percent for the whole year, which the coal industry will be able to maintain.

According to other sources, the more smooth supply of coal this year was also the result of government measures to tighten control over the coal market.

The State Council's new moves concern more strictly-controlled coal prices for the China National Coal Corporation which runs major State-owned mines.

The corporation plans to turn out 350 million tons of coal this year, or one-third of the nation's annual target.

A ceiling price has been set for that amount of coal beyond the State-set quota of 350 million tons.

It was stipulated that coal beyond the State target can be sold only within a price range of between 100 to 250 percent more than its State-controlled portion.

Machinery Imports To Aid Jungar Project

40100073B Beijing CHINA DAILY in English 28 Aug 90 p 1

[Article by Xie Songxin: "Imports To Aid Huge Coal Project"]

[Text] China is to import machines for the construction of the largest coal development project in the country—the Jungar Coalfield in Inner Mongolia.

The first batch of purchases will include excavating and conveying machines, heavy-duty trucks and equipment for a coal separation plant, according to Yang Handong, a manager from the China National Technical Import and Export Corporation.

The corporation, which is responsible for the procurement, was due to start seeking price quotations from international machine-builders today. Xiong Quangen, the company's vice-president told representatives of overseas manufacturers yesterday in Beijing.

The import is backed by a \$280 million loan under the second energy loan programme from the Japanese Government. The loan would cover another batch of buying to take place soon, Yang said.

The Jungar Coalfield, an open-pit mine which began construction last month, is top of the State Council's list of 27 energy projects for 1990.

Located 127 kilometres north of Hohhot, Inner Mongolia, Jungar is expected to realize 27.2 billion tons in coal reserves.

With an investment of 4.14 billion yuan (\$281 million), the mine will produce 15 million tons of coal a year on completion of its first phase of construction which also includes a 216-kilometre electrified railway line, a 200,000-kilowatt coal-fired power plant and a separation plant.

The development of the coalfield would ease acute power shortages in Northeast China, Beijing, Tianjin and parts of East China, Song Hanfeng, general manager of the Jungar Coal Industry Corporation said, adding that it would also help promote prosperity in the Inner Mongolia Autonomous Region, one of the most underdeveloped regions in China.

More Government Investment To Boost Shanxi Coal Output

40100075A Beijing CHINA DAILY in English 5 Sep 90 p 2

[Article by staff reporter Chang Hong]

[Text] Taiyuan—The central government has plans to increase the output of its largest coal-producing province by appropriating additional investments over the next five years.

The appropriations, the amount of which are to be finalized by the State Planning Commission later this

year, will cover the construction of eight coal mines, six power plants and the upgrading of several other mines, Governor Wang Senhao told CHINA DAILY yesterday.

The province turned out some 300 million tons of coal in 1989, or one-third of the country's total. And 80 percent was transported for use outside the province.

According to Wang, a few of the planned new mines are in Datong, China's leading steam coal producer, and Gujiao, the industry's top coking coal supplier.

Major State-run mines in Datong produced 34 million tons of coal in 1989, 10 percent of the total output of the China National Coal Corporation, which takes care of the industry's 618 State-owned mines.

Wang said the central government is planning another 15-million-ton opencast mine adjacent to the much-heralded Sino-U.S. joint venture coal project in Pingshuo.

The six power plants on the government's blueprint for the next five years will add 2 million kilowatts in total capacity to the existing 5.3 million kilowatts.

At present, a quarter of the electricity is transmitted to the nation's power-restricted regions in North and Northeastern China.

Apart from the as yet undecided central government investment, the province will spend at least 6 billion

yuan (\$1.3 billion) to purchase mining and safety equipment for its locally-run mines, whose output has outpaced their State-run counterparts.

The provincial government expects an output increase of 50 million tons from these smaller mines by the end of 1995.

Shanxi has proven coal deposits of 233 billion tons, which the central government expects to be the backbone of the industry up to the year 2000.

"The construction (of the energy base) will continue to be the priority of the province's development for the next 10 years," Wang said in an interview in the provincial capital.

The central government decided in the early 1980's that Shanxi should be developed as the country's leading power house, which includes coal mines, coal-fired power plants, and railway networks for coal transportation.

The governor said the current sluggish coal sales, which experts blamed on a reduced demand, is temporary.

"It will be in short supply in the long run," he assured CHINA DAILY.

Provincial statistics indicate 50 million tons of coal in stock, which has caused a significant drop in coal production as a result.

Ten-Year Plan for Oil Industry Unveiled

*40100073A Beijing CHINA DAILY (Business Weekly)
in English 27 Aug 90 p 1*

[Article by staff reporter Huang Xiang]

[Text] China's offshore oil industry has unveiled a 10-year development strategy which will make use of overseas assistance.

The strategy encourages more international co-operation in field operations in the South China Sea, in the initial exploration of the East China Sea and in developing offshore petrochemical works, Business Weekly learned yesterday.

And the China National Offshore Oil Corporation (CNOOC) vows to create a better environment for overseas investment over the next 10 years.

"Despite complicated geological conditions, the potential of China's offshore oil development is enormous," said corporation spokesman Wu Kunduo.

Wu said joint efforts in the field had proved fruitful over the past decade and had resulted in an atmosphere of trust and understanding growing up among partners.

So far, he said, CNOOC had signed 58 offshore oil contracts with 46 firms from 12 countries, including such industrial giants as Esso, Mobil, and Shell.

A total of \$2.7 billion in overseas capital was involved in the contracts, most of which were still being carried out.

According to Wu, of the 18 oil and gas fields CNOOC had found in the South China Sea and the Bohai Sea, 12 were joint projects.

Four joint venture oilfields had been put into operation over the past 10 years, with a total capacity of 1.4 million tons a year, he said, adding that these oilfields had produced 159,200 tons of crude oil during the first half of this year.

With another new oilfield due to go into operation soon, CNOOC was optimistic about being able to meet the year's target of 1 million tons, he said.

"That is not a big output compared with those on-shore oilfields, but we've got a good start," one corporation official noted.

The country turned out 136 million tons of crude oil last year, including 900,000 million [as published] tons from the offshore fields. But the prospects for a significant increase in output were dim for the next few years as many of the industry's key oilfields on land were now too old to produce any more oil.

Meanwhile, according to a CNOOC source, the corporation was intensifying the construction of another seven oil and gas fields in the two seas, four of which were joint ventures.

The corporation expected 5 million tons of crude oil and 500 million cubic metres of natural gas to be produced each year by 1992 and 8 million tons of oil and 5 billion cubic metres of gas by 1995.

Under the long-awaited strategic plan, CNOOC will start to build major crude oil production bases in the western part of the South China Sea, where many of the world's leading firms in the fields have been working for more than a decade.

The area, which includes the Yirgehai basin, the Southeast Qiong basin and the Pearl River estuary basin, may have trillions of cubic metres of natural gas.

Wu said the Chinese Government had approved the Ya 13-1 gas field, a joint gas project between CNOOC and two foreign firms.

The project would supply natural gas to the provinces of Guangdong and Hainan, where the power shortage is acute, and to the overseas market in the form of liquified gas.

Also on CNOOC's blueprint is the tapping of the East China Sea, a virgin area whose thick sedimentary rocks promise substantial oil and gas reserves.

Wu said CNOOC would get fully prepared to open up the region with overseas partners over the next 10 years.

A corporation official said almost all the world's major oil firms had expressed an interest in the exploitation of the sea.

The 10-year plan also calls for the establishment of big offshore oil refineries and other major petrochemical projects.

"We have learnt from experience that an oil firm has to develop such projects to increase profits and reduce risks," Wu said.

At present CNOOC, together with four other Chinese firms, is planning to set up a major petrochemical works with the Shell Company in Guangdong Province.

The project, which will include China's largest oil refinery and ethylene plant, will be in Huizhou and will cost an estimated \$2 billion.

The refinery will have an annual capacity of 5 million tons and the ethylene plant will be able to produce 450,000 tons of chemical products.

The project, which has been regarded as a pioneering one in the field, has yet to be approved by the State Planning Commission.

Tarim: Will Hopes for Giant Oil Field Be Dashed?

906B0068A Beijing LIAOWANG [OUTLOOK] (Overseas Edition) in Chinese No 19, 7 May 90 pp 18-19

[Article by Bu Yuntong [0592 0061 1749] and Fan Yingli [2868 5391 0448]: "Tarim: Strategic Replacement Region for China's Petroleum"]

[Text] Not long ago, Tazhong-1 [central Tarim] well in the middle of the Taklimakan Desert erupted with high-output industrial oil. The first discovery of a large oil deposit in marine facies sediments abruptly shifted the focus of state petroleum exploration and development from east to west China.

The relevant experts feel that Tarim will become the most hopeful strategic replacement region for China's petroleum.

I. Few Oil Sources in East China

China's petroleum industry has insufficient reserves. In 1988, China produced a total of 100.37 million tons of crude oil, fifth place in the world. Most of our crude oil came from Daqing Oil Field on the Songliao Plain and from Shengli Oil Field and Liaohe Oil Field located near the Bohai Basin. Daqing Oil Field produced 56 million tons, nearly one-half the total [as published]. Although crude oil output in China has grown at a yearly rate of 3 percent, we are under an extreme strain.

China has now put 170 large and small oil fields into production and their total crude oil output now accounts for more than 50 percent of our reserves, so less than one-half remains. This fact is troubling. Excluding Zhongyuan Oil Field, the water content at several primary oil fields has surpassed 70 percent, and Daqing Oil Field has reached 73 percent. Even thin 0.5 meter oil strata are not being passed up. It will be quite difficult to stabilize output at oil fields in the middle and late stages of exploitation. In the early 1980's, injecting 2 tons of water could produce 1 ton of crude oil, but now 4 tons must be injected, which is double the work. In 1988, there was a net increase of 3 million tons in crude oil output in China, but it actually took nearly 20 million tons of work to accomplish.

The amounts available per capita are hardly inspiring. In 1988, world crude oil output per capita was 580 kilograms, but this figure in China was just 124 kilograms, less than one-fourth world per capita levels.

Even more troubling is that China's geological petroleum reserves have entered the early stages of extreme difficulties. To increase crude oil output to the projected 200-million-ton level by the end of this century, China will have to prove 800 million tons in new geological petroleum reserves each year. Actually, we now prove just over 500 million tons annually. China is using joint investments with foreign petroleum companies for offshore exploration and some geological achievements

have been made in our four main seas, but there have been no earth-shaking discoveries.

II. Will Our Dream of Big Oil Fields Be Dashed?

Songs of praise for Tarim have been sung for years. Some people have said that Tarim has petroleum reserves equal to Daqing or even several Daqings, and some have even said that it is equivalent to mideastern oil field. After a dry hole was drilled in the desert at Manxi-1 well in September 1988, some offered projections that the area of the oil deposit would be reduced by half.

Estimates of Tarim's petroleum resources range from 10 billion tons to 30 billion tons. Geologists have said that resources are unreliable and that it is not unusual for projections to vary by a factor of 10. Could dreams of a big oil field at Tarim be dashed?

Qiu Zhongjian [6726 0022 0256], deputy commander of the Tarim Petroleum Exploration and Development Headquarters, is quite confident. This deputy chief geologist in the China Petroleum and Natural Gas Corporation said Tarim's petroleum resources far exceed the original estimates of 10 billion tons.

Although surveys in northwest Tarim were rushed to the front in 1977 when underground structures were unclear, China has imported several pieces of advanced seismic equipment and desert fighting tools and hired three seismic teams from the United States since 1979. We have also organized seven desert seismic teams and carried out large-scale and careful prospecting work at Tarim. Prospecting has provided major breakthroughs in our geological understanding of Tarim. We have already confirmed four sets of primary petroleum strata systems, oil strata 4,000 to 8,000 meters thick, and an extremely thick foundation of oil-generating material. The oil reservoir structures are huge. They include the Tazhong [central Tarim] oil reservoir structure which covers 8,200 square kilometers, first place in China and one of the largest in the world.

The strata drop in the eastern part of the Chinese mainland increases by 3.6°C to 4°C per 100 meters, whereas the temperature gradient in Tarim is just 1.7°C to 1.9°C, so this eliminates concern that there is only natural gas and no petroleum because the temperature is too high.

At present, every well drilled in the Lunnan [south Luntai] region in northern Tarim Basin has produced oil and a row of Daqing-type oil fields has appeared. Experts expect to find 1 billion tons in reserves in this area in the first half of 1990 which could be built into a 1 million ton crude oil production capacity. It could reach 20 million tons by 1995. This would make Tarim the "third elder brother" second only to Daqing and Shengli.

III. Economic Feasibility

Chief engineer Li Dahua [2621 1129 5478] in the Tarim Petroleum Battle Headquarters said that there would be

no significant technical problems after comprehensive development begins. Desert oil prospecting techniques are relatively mature in foreign countries. In the United States it takes just a few 10 personnel to manage and operate an oil field with a 3 million ton yearly output, and we can import and digest their management experiences. From the perspective of economic benefits, although Tarim is located in a frontier region and would involve long transportation lines and high well drilling costs, oil well output would also be especially high. The 10 producing wells there now produce about 150 tons per day, and Lunnan-2 well has produced 170 to 180 tons of crude oil daily since 5 June 1989. This contrasts to average daily output of just 13 tons or so in east China oil fields. A comprehensive assessment indicates that the economic benefits from Tarim would be somewhat higher than east China's oil fields.

Regarding the question of planning in Tarim Basin, initial plans envisaged by the China Petroleum and Natural Gas Corporation based on a 20 million ton crude oil production scale call for building a large oil refinery and several ethylene and polyester projects at Korla. Two 300,000-ton or one 500,000-ton synthetic ammonia plants could also be built. The capital problem could be solved by foreign loans and we would be able to repay them. Raising capital from south China and repaying with oil is another route.

Experts feel that it would be more economical to ship out the crude oil via pipeline. What is still undecided is shipping crude oil to foreign countries and the question of downstream project construction. If we can grasp industrial reserves of 1 billion yuan in 1990, however, the time for even higher-level deployments would have arrived.

China Petroleum and Natural Gas Corporation general manager Wang Tao [3769 3447] predicts that during the Eighth 5-Year Plan, the rate of increase in crude oil output from Tarim will determine the level of increase in crude oil output for China as a whole.

It would seem that the time for large-scale development of Tarim petroleum is not far off.

Foreign Drillers To Be Allowed in East China Sea

40100075B Beijing CHINA DAILY (Business Weekly Supplement) in English 3 Sep 90 p 1

[Article by staff reporter Huang Xiang]

[Text] The opening of the East China Sea to the outside world is only a matter of time as the government is intensifying preparations to tap the nation's last, and perhaps richest, virgin territory of offshore oil and gas.

China National Offshore Oil Corporation (CNOOC), the industry's sole representative for international cooperation, has urged initial moves in a report to the central government.

"We'll act on the general planning of our government to develop the area with foreign firms," a CNOOC source said.

Until now, foreign companies have operated more in the Bohai Sea and the South China Sea, where oil and gas reserves are more promising than those in the Yellow Sea. Exploration there has virtually stopped.

According to the corporation, more than a dozen foreign oil companies have made inquiries of the whole undertaking, and are especially interested in the arrangements on the Chinese side.

There used to be speculation that the Chinese might develop the region on their own, a proposition actually advocated by some officials and experts in the government.

They urged domestic investment should concentrate on one or two rich verified oilfields. In this way, they argue, the sale of more products will help recoup the invested capital.

But this proposition was refuted by a CNOOC spokesman who told Business Weekly that "developing the area on our own is beyond our ability."

To sink an offshore well may cost \$8 million to \$10 million, several times more than that for a well on-shore. Lack of funding is especially acute at present because of the retrenchment programme.

He said the East China Sea, with 460,000 square kilometres of continental shelf, might be open to international bidding or to the Japanese only.

Currently foreign firms, except as hired hands, are not allowed to develop China's on-shore oil reserves. But the use of foreign equipment and technologies is widespread.

So far, CNOOC had signed 58 offshore oil contracts with 46 firms from 12 countries, including such world-famous names as Esso, Occidental, Shell and BP Petroleum Development Ltd.

But in the case of the East China Sea, drilling operations are jointly undertaken by CNOOC and the Ministry of Geology and Mineral Resources.

Recent prospecting has revealed the existence of an oil and gas field and four oil-and-gas-bearing structures, according to a Ministry report.

But it did not give the verified figures of the oil field, which some experts describe as medium-sized.

Shanghai newspaper put the estimated reserve in the entire continental shelf at four billion tons, larger than many of those on-shore.

But many in the industry hold that despite hopeful preliminary findings, the industry has yet to determine a large oil field, or one that has one million tons in reserve.

Out of the 17 wells the ministry has sunk in the past decade, eight showed up oil and gas currents.

Pinghu No. 4, which was drilled last year, is capable of producing 1,892 cubic metres of light oil and 1.5 million cubic metres of natural gas every day, the highest daily output in China's marine oil production.

According to other reports, the Shanghai Municipal Government plans to develop the natural gas reserves in Pinghu for civilian consumption in the 10-million-resident metropolis, which is about 450 kilometres away in the southeast.

A municipal official said the planned project, due to start next year and be completed by 1994, is expected to solve the city's shortage of cooking fuel.

The Shanghai project is regarded by some as the first step towards the substantial development of the East China Sea.

There are optimists who encourage immediate moves, which they contend would significantly ease the strain of electric power and chemical raw materials in East China, one of the nation's most developed but power-restricted regions.

However, according to other sources, large-scale development of the sea will not start until the Ninth Five-Year Plan period (1996-2000).

But authorities could not be reached for confirmation.

Last year the nation pumped 136 million tons of crude oil, of which only 900,000 tons came from offshore producers in the Bohai Sea and the South China Sea.

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